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Research Report: ZLC-2009-14
Optimization of the Air Cargo Supply Chain
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Optimization of the Air Cargo Supply Chain

María Pérez Bernal

EXECUTIVE SUMMARY

Air freight transportation has been increasing recently in Spain, in spite of passengers taking precedence over cargo, which is determined by passengers. Air companies that operate in Spain are mainly domestic and their peripheral geographic position restricts the entrance of freight to Central Europe. Air supply chain is composed of several agents such as air companies, airports, couriers, customs, forwarding and handling agents. Its operation is very complex due to a large number of intermediaries and the strict controls that air freight is subjected to. Nowadays, air cargo transportation is competitive for express, perishables and valuable products due to its high cost. Optimizing the chain in terms of cost and time reduction would allow other niche markets to enter.

Aim of study

By integrating all the operations, this thesis demonstrates that efficiency of the air cargo supply chain can increase, as well as that of its different links. Efficiency is measured in terms of time as a percentage of the increase outflow of the system and in terms of cost reduction as a percentage of the savings of resources. The specific objectives of this study are to improve air cargo efficiency by:

- Identifying and removing bottlenecks
- Improving operations
- Assigning, removing or reallocating resources
- Improving relations among agents
- Optimizing capacity of warehouses

Approach

For this aim, a tool was developed using a process simulation modeling software, WITNESS, which provided information to the decision-makers about the most relevant parameters subject to optimization. In order to show the power of the tool, an example of the case of Zaragoza Airport is illustrated. It is followed by a sensitivity analysis, considering three different scenarios.

Conclusions

- By integrating operations in the air cargo supply chain, relations among agents would improve and hence, operations themselves.
- The tool developed could optimize the whole chain or any of its components and would help decision-makers by providing them information about the performance of each link in the chain.
- For a given demand and a certain service level in exports, trucks could be reduced 33% and forklifts up to 40% at origin site.
- For a given demand and a certain service level in exports, staff of forwarding agents and handling agents could be reduced 25% each at origin site.
- The tool allows for identifying bottlenecks. By creating a workplace and reallocating labor, a reduction of 78% is achieved in documentation. With two workplaces in customs and allocating another customs agent, the bottleneck has been totally removed. These improvements imply an increase of 24% in flows.
- By running the model an adequate number of times, it is able to identify the trends of maximum capacity and average size of buffers at origin site to optimize the capacity of warehouses and buffers. Airport facility has reduced its slope, although it should be oversized because of the increasing trend. Moreover, waiting for customs has become unnecessary.

Recommendations

The model has a high number of variables. In order to execute it properly, the first step is to choose the factors that the user considers most relevant. Then, vary them one at a time to analyze the effect of each. Afterwards, the most significant scenarios can be merged, verifying that the combined result is more enhanced than the individual ones. Furthermore, validating the model would be beneficial. The tool could be implemented in a complete chain as an integrator or just for a certain agent. Depending on the supply chain, the model should be customized to adjust for a specific performance.

Limitations

The access to data is the most complicated issue in this model. Companies are distrustful for transferring their data. In addition, the software used is not intuitive and its interface is complex. Because of this, the user should be trained in the specific software beforehand.

Further Research

This research could be continued considering different alternatives about the choice of the air cargo supply chain paths. The volume of packages and capacity of vehicles could also be taken into account, finding the best solution for their loads. Furthermore, it could be extended to include commercial flights, where cargo is loaded in the hold with luggage, conditioned by the remaining space. Moreover, a network of airports could be included, helping the forwarding agent in the decision-making process to send freight from one airport or another, depending on the performance of each supply chain.